THE NATURAL HISTORY AND IMMATURES OF *SCAPHISOMA IMPUNCTATUM* (COLEOPTERA: SCAPHIDIIDAE)[1,2]

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ABSTRACT: The egg of *Scaphisoma impunctatum* Reitter is spherical and enveloped in a mucous-like wrap. The three larval instars can be distinguished from each other by head width and by morphology of the labral crenulations and antennal segments. Larvae of *Caryoscapha americanum* Löbl and *Scaphisoma* spp. can be distinguished by the morphology of the mandible, color patterns of the head, and the arrangement of the stemmata. Larval and pupal chaetotaxy are identical for described species. Preliminary data on immature forms supports subgeneric rank of *Caryoscapha* in *Scaphisoma*. *Scaphisoma impunctatum* larvae burrow into the stalks of *Tremellodendron pallidum* and pupate at the base of the fungus.

Scaphisoma and *Caryoscapha* are sister genera (Löbl, 1987). Ganglbauer (1899) originally erected *Caryoscapha* as a subgenus of *Scaphisoma* but it was subsequently raised to generic rank (Löbl, 1987).

Both larvae and adults of *Scaphisoma* and *Caryoscapha* feed on Basidiomycetes. *Scaphisoma* is common on Polyporaceae and less so on Hydnaceae, Clavariaceae and Agaricales (Newton, 1984). *Caryoscapha americanum* Löbl, (1987) was described from specimens found on Agaricales and a polypore. Ashe (1984) reviewed data concerning scaphidiid natural history which was included with his descriptions of the larva and pupa of *Scaphisoma terminatum* Melsheimer and the larva of *Scaphium castanipes* Kirby. Examination of Ashe's material revealed that the *S. terminatum* were in fact *C. americanum,* which was described subsequent to Ashe's study.

The immatures of the European species of *Scaphisoma agaricinum* L. were studied by Perris (1877) and Kasule (1966, 1968). Ashe's (1984) detailed descriptions and Newton's (1988) recent characterization of immature forms of Scaphidiidae provide a framework for additional studies.

The objectives of this paper are to describe or compare the immature stages of *Scaphisoma impunctatum* Reitter with *C. americanum* and discuss their taxonomic status. A detailed discussion of the natural history of *S. impunctatum* is presented.

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METHODS

Larvae and adults were collected from Basidiomycete hosts during 1986 and 1987. Larvae, with their respective hosts, were brought into the laboratory and reared at room temperature. A rearing chamber consisted of a large circular glass bowl covered with plate glass. The chamber contained moistened berlesate/sawdust substrate.

Field-collected specimens were preserved in 70% alcohol and lab-reared specimens were preserved in Khale's solution. Identifications of pinned adults were confirmed by Dr. Ivan Löbl, Museum d'Histoire naturelle, Geneve (MHNG). *Scaphisoma impunctatum* has been tentatively identified as such, based on a single female type; however based on male characters it appears to belong to the same species group as *S. rufulum* LeConte and *S. obesulum* Casey (Löbl, pers. com.).

Eggs of *S. impunctatum* were slide mounted in CMCP-10 mounting media and examined. Larvae were treated in cold 10% KOH for up to 3 days or until clear, then washed in 70% alcohol and dissected. Body parts and whole specimens were mounted on slides in CMCP-10 or CMCP-9AF mounting media. Mandibles were air-dried and prepared for scanning electron microscopy (SEM). Pupae were soaked in alum cochineal for 10 minutes, rinsed in 70% alcohol and examined with a compound microscope.

For larvae, lengths (L) are expressed as a range, and head capsule widths (HW) are expressed as means (x) and ranges (r). Pupae and egg lengths are also expressed as a mean. Measurements were calculated using a whipple grid mounted inside an ocular of a wild M-5 dissecting microscope.

Scaphisoma impunctatum Reitter

Egg. L = 0.40 (N = 7). White, smooth, spherical; enveloped within a mucous-like wrap (Fig. 8, 11).

Larva. First instar (N = 15): L = 1.10 - 1.40 mm; HW = 0.31 mm (r = 0.29 - 0.32 mm). Head yellow; anterior margin of labrum deeply crenulate, (Fig. 1); antenna compact (Fig. 3). Second instar (N = 19): L = 1.16 - 3.50 mm; HW = 0.40 mm (r = 0.37 - 0.42 mm). Head yellow; truncate labrum with anterior margin crenulate (Fig. 2); antenna elongate (Fig. 4). Third instar (N = 98): L = 1.83 - 4.00 mm; HW = 0.50 mm (r = 0.49 - 0.57). Head (Fig. 7): yellow, pigmented with dark macula surrounding stemmata, stemmata groups divergent, labrum same as second instar; antenna elongate (Fig. 5), mandible with 2 long acute apical lobes and a subapical psuedomola with a field of long spines (Fig. 9). All other characters the same as for *C. americanum* (Ashe, 1984).

Pupa. L = 2.45 (N = 2). White, eyes not developed. All other characters the same as for *C. americanum* (Ashe, 1984).

Material examined. *Caryoscapha americanum. Arkansas.* Logan Co., Cove Lake, Ex *Hericium erinaceus,* R. Leschen, 1 Nov. 1986 (3 larvae, 9 reared adults). *Illinois.* Jackson Co., Ferne Clyffe State Park, Ex *H. ramosum,* J.S. Ashe, 23 Oct. 1982 (12 larvae, 3 pupae, 6 reared adults). *Oklahoma.* Latimer Co., 5 mi. SW of Red Oak, Ex *H. ramosum,* R. Leschen, 3 Nov. 1987 (9 associated adults, 59 larvae, 13 pupae, 93 reared adults).

Scaphisoma impunctatum. Arkansas. Logan Co.: Cove Lake, Ex *Tremellodendron pallidum,* R. Leschen; 3 June 1986 (6 larvae, 1 pupa, 4 reared adults); 24 June 1987 (45 associated adults, 70 larvae, 1 pupa, 66 reared adults); Mt. Magazine, *T. pallidum,* R. Leschen (9 associated adults, 8 larvae); Garland Co., Camp Clearfork, Ex *T. pallidum,* R. Leschen, 12 June 1987 (8 associated adults, 5 larvae); Washington Co., L. Wedington, Ex *T. pallidum,* R. Leschen, 12 June 1987 (17 associated adults, 40 larvae, 21 reared adults).

Scaphisoma sp. *Arkansas.* Logan Co., Mt. Magazine, 5 June 1987, *Phanerochaete chrysorhizon,* R. Leschen (1 larva).

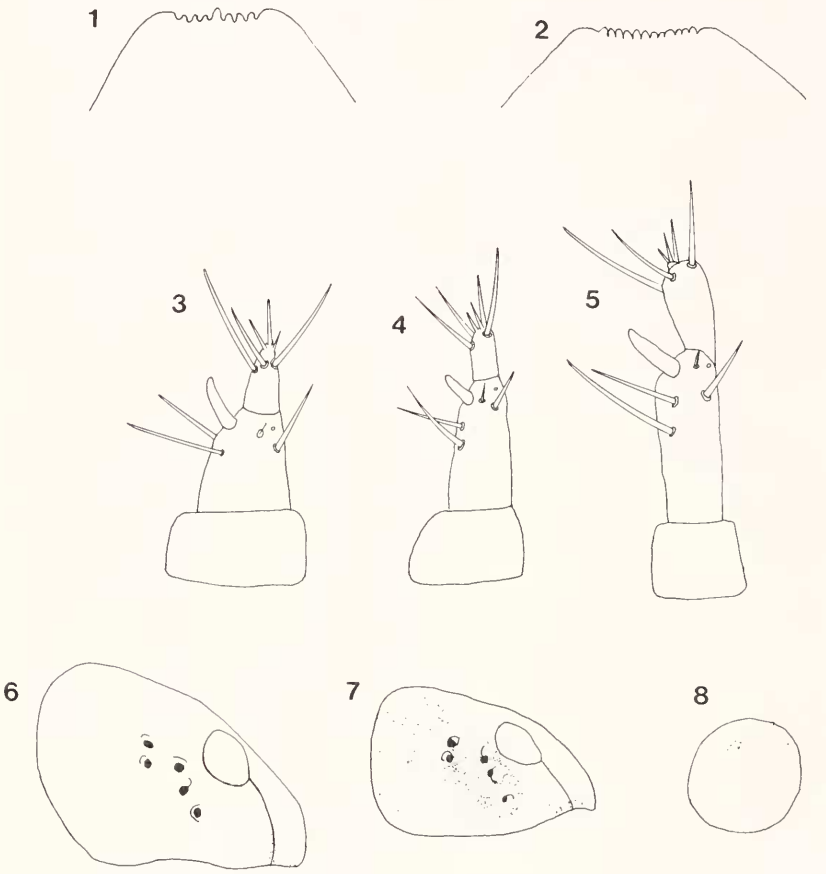
Voucher specimens were deposited as follows: 1. MHNG, 10 larvae and 10 adults of *C. americanum* and 6 adults of *S. impunctatum.* 2. Field Museum of Natural History, Chicago, (FMNH) 10 larvae, 5 pupae and 10 adults of *C. americanum* and 10 larvae and 10 adults of *S. impunctatum.* 3. Remainder in the R.A.B. Leschen Collection and the University of Arkansas Insect Collection.

Remarks. The egg description agrees with Newton (1988), with the exception of the mucous-like wrap which is unrecorded for Scaphidiidae. This mucous-like wrap is easily dissolved in 70% alcohol. A similar egg wrap occurs for the staphylinid *Trichopsenius* (Trichopseniinae) (Crowson, 1981). A micropyle was not observed, only the stemmata of the first instar larva (Fig. 8). No egg-bursters were observed on the first instar larva, however some lateral setae on the thoracic terga appear rigid and may assist in hatching.

Instars can be distinguished not only by proportions, but by: 1) First instar with deeply crenulate anterior labral margin and a compact stubby antenna. 2) Third instar with pigmented head capsule and a dark macula surrounding the ocelli. 3) Second instar without the above combined characters.

Larvae and pupae of *S. impunctatum* are almost identical to those of *C. americanum.* Larvae of *S. impunctatum* can easily be distinguished from *C. americanum* by the presence of pigment on the head capsule and a mandible with long acute incisor lobes and a subapical pseudomola with long spines. The pharate adults of *C. americanum* have triangular palpi, which are absent in *S. impunctatum.*

Rearing notes. Pupae were observed 11 days after collection date. Adults emerged 17-41 days after collection date.



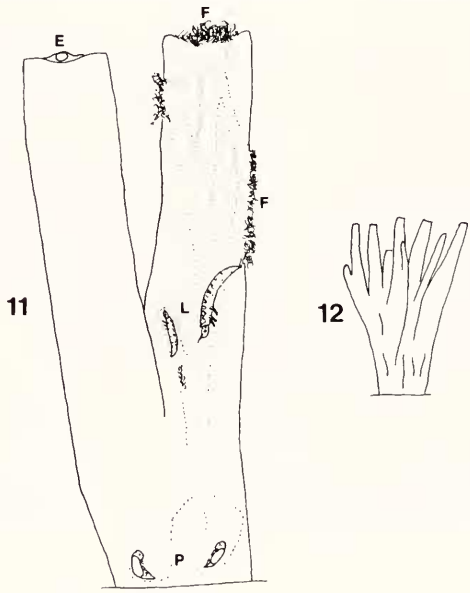
Figs. 1-8. *Scaphisoma impunctatum* 1-5: 1. First instar, anterior margin of labrum. 2. Second instar, anterior margin of labrum. 3. First instar, dorsal aspect of right antenna. 4. Second instar, dorsal aspect of right antenna. 5. Third instar, dorsal aspect of right antenna. 6. *Caryoscapha americanum* third instar, lateral aspect of head capsule. 7. *S. impunctatum* third instar, lateral aspect of head capsule. 8. Egg of *S. impunctatum*.

Figs. 9, 10. 9. Scanning electron micrograph (SEM) of *Scaphisoma impunctatum* left mandible, ventro-mesal view. 10. SEM of *Caryoscapha americanum* left mandible, ventro-mesal view.

Based on the material examined, head capsule pigmentation is present in *Scaphisoma* (Fig. 7) and absent in *Caryoscapha* (Fig. 6). Mandibular morphology appears to be the most informative character for species determination, however, the mandible of *C. americanum* (Fig. 10) resembles *S. agaricinum* as illustrated by Kasule (1966, 1968). Stemmatal arrangement may also be an informative character for species separation.

All other larval characters including chaetotaxy and position of cephalic and tergal glands are identical for both *Caryoscapha* and *Scaphisoma.* These data agree with Ganglbauer (1899) who originally erected *Caryoscapha* as a *Scaphisoma* subgenus. However, based on adult characters, Löbl's (1987) opinion is to consider *Caryoscapha* a distinct genus.

Tremellodendron pallidum (Schw.) Burt. (Tremellales) is a reproductive host for *S. impunctatum* (Figs. 11, 12). Its flesh is relatively tough, unlike the coral fungi (Clavariaceae) which it superficially resembles. Like *Hericium* (Hydnaceae), the reproductive host of *C. americanum, T. pallidum* has a distinct season but in contrast is not lignicolous and is found gregariously during late May through June. In the laboratory



Figs. 11, 12. *Tremellodendron pallidum:* 11. Diagrammatic representation of *Scaphisoma impunctatum* development from egg to pupa. 12. Habitus sketch. E = egg. F = frass. L = larva. P = pupa.

fruiting bodies retain their structural integrity for up to a period of one month.

Structural densities of the fungus hosts appear to correspond to the structure of the larval mandible. Those larvae which feed on the softer *Hericium, C. americanum,* have short apical lobes and a subapical mola consisting of numerous short spines (Fig. 10). In contrast, *S. impunctatum,* which feeds on the tough *T. pallidum,* has long apical lobes and a subapical mola consisting of well-developed long spines (Fig. 9).

Scaphisoma impunctatum females deposit eggs singly on fresh tips of *T. pallidum,* or when not so fresh, anywhere on the sporocarp. When sporocarps are fresh, larvae tunnel into the stalk and pile frass at locations where the tunnel is exposed to the outside (Fig. 11). As the number of larvae and visiting adults increase over time larvae can be seen feeding on the outside surfaces of the sporocarp. Eventually third instar prepupae burrow at the base of *T. pallidum* and pupate, often gregariously. In the laboratory some pupae were observed in the rearing substrate. Duration of each instar is unknown.

Scaphisoma impunctatum larvae feed in a similar manner to that described for *C. americanum* (Ashe, 1984). However, *C. americanum* did not pupate in the flesh of *Hericium* and Ashe suggested that this was related to the decay and degradation of the host. Larvae and pupae tentatively identified as *S. convexum* were also discovered feeding and pupating within their host *Schizopora paradoxa* (Fr.) Donk. (Polyporales). Perris (1877) noted that the European species *S. agaricinum* pupae were attached to the gills of its lignicolous host. Probably under natural conditions larvae pupate in the soil and in or near the fungus host.

Other scaphidiids reared from *T. pallidum* were: *Toxidium gammaroides* LeConte (1 adult) and *Cyparium flavipes* LeConte (1 larva, 12 adults). Newton (1984) reported *Cyparium terminale* Matthews on a *Clavaria* (Clavariaceae) host, tunneling into the branches. He also has found additional specimens of undetermined *Scaphisoma* on Clavariaceae.

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